

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 1. (Currently amended): An allocation method for a storage area of a storage
2 device to a virtual volume in a storage system having a plurality of virtualization apparatuses that
3 allocate the storage area which the storage device has, form a plurality of virtual volumes, and
4 process input-output from a host processor to one of the virtual volumes, comprising the steps
5 of: allocating a plurality of logical volumes to form a plurality of virtual volumes among a
6 plurality of virtualization apparatuses, the virtualization apparatuses being coupled to a plurality
7 of host computers and to a storage device, the logical volumes related to at least one disk drive in
8 the storage device, the virtual volumes processing input-output requests from the host computers,
9 the method comprising steps of:
10 issuing, to the plurality of virtualization apparatuses, a request for completing all
11 input-output requests received from the host processors that are being processed by the
12 virtualization apparatuses and temporarily holding any subsequent input-output requests received
13 from the host processors;
14 receiving, from the plurality of virtualization apparatuses, a completion report of
15 the input-output requests being processed by the virtualization apparatuses in response to the
16 request for completing;
17 sending an instruction of an allocation change of ~~logical volumes~~ the storage area
18 of the storage device to all the virtualization apparatuses upon receiving completion reports from
19 all the virtualization apparatuses to which the request for completing was issued;
20 receiving a completion report of the allocation change from all the virtualization
21 apparatuses; and
22 sending an instruction to all the virtualization apparatuses for releasing the input-
23 output request that are being temporarily held,

24 wherein a virtualization apparatus that did not send its completion report is
25 removed from a control range and the allocation of its storage area is not changed.

1 2. (Currently amended): An allocation method according to claim 1, wherein
2 a table storing configuration information that associates the virtual volume with the storage area
3 ~~logical volumes~~ that becomes a real area of the storage device is prepared in a memory in
4 advance, and
5 when the instruction of an allocation change of the storage area is sent, difference
6 information of the configuration information is sent, and the virtualization apparatus changes the
7 configuration information on a relevant entry of the table.

3. (Canceled)

1 4. (Previously presented): An allocation method according to claim 1,
2 wherein whether a subsequently received input-output request is held temporarily or not is
3 controlled aiming at an address range including a location where the allocation is changed on the
4 virtual volume.

1 5. (Currently amended): An allocation method according to claim 1, further
2 comprising, for a virtual volume with newly allocated storage area~~logical volumes~~, copying data
3 from ~~logical volumes~~storage area previously allocated to the virtual volume to the newly
4 allocated storage area~~logical volumes~~.

1 6. (Currently amended): A storage system, comprising:
2 a storage device that can specify a plurality of storage areas~~logical volumes~~;
3 a plurality of virtualization apparatuses that allocate the ~~logical volumes~~storage
4 area to form a plurality of virtual volumes, and to process input-output requests sent from a
5 plurality of host processors to one of the virtual volumes; and
6 a configuration change controller for changing an allocation configuration of the
7 storage area~~logical volumes~~ to the virtual volumes, wherein

8 the configuration change controller includes:
9 means for requesting temporary hold of input-output requests to the virtualization
10 apparatuses,
11 the virtualization apparatus that received the request includes:
12 means for completing all input-output requests received from the host processors
13 that are being processed by the virtualization apparatus, shifting to a state of temporarily holding
14 subsequently received input-output request from the host processors, and returning a completion
15 report of processing of the input-output requests to the configuration change controller, and
16 the configuration change controller includes:
17 means for instructing an allocation change of the storage area~~logical volumes~~ to
18 the virtual volume to the virtualization apparatus when receiving the completion report from all
19 the virtualization apparatuses to which a request was issued,
20 wherein a virtualization apparatus that did not send its completion report of the
21 input-output processing is removed from a control range and the allocation of its storage area is
22 not changed.

1 7. (Currently amended): A storage system according to claim 6, wherein
2 the configuration change controller includes:
3 a configuration change control program that includes the request means, means
4 for receiving the completion report from the virtualization apparatus, and the change instruction
5 means;
6 a processor that executes the configuration change control program;
7 a memory that stores a configuration information table registering configuration
8 information that associates the virtual volume with the storage area~~logical volumes~~—that
9 becomes a real area of the storage device and a difference information table recording a
10 difference before and after the change of the configuration information,
11 the virtualization apparatus, includes:
12 a configuration management program that performs processing of a configuration
13 change;

14 a processor that executes the configuration management program; and
15 a memory that stores a configuration information table registering the
16 configuration information that associates the virtual volume with the storage area logical
17 ~~volumes~~ that becomes the real area of the storage device and a difference information table
18 recording the difference before and after the change of the configuration information, and
19 the configuration change controller sends the difference information of the
20 configuration information to the virtualization apparatus with reference to the difference
21 information table when sending the instruction of the allocation change of the storage area logical
22 ~~volumes~~, and the virtualization apparatus executes the configuration management program by the
23 processor and changes the configuration information of a relevant entry of its own the
24 configuration information table in accordance with the received difference information.

1 8. (Original): A storage system according to claim 6, further including a
2 management console comprised of an input unit that inputs a request of the change of the
3 configuration information to the configuration change controller and a display unit that displays
4 a status of the configuration change.

1 9. (Currently amended): A virtualization apparatus that allocates ~~logical~~
2 ~~volumes~~ a storage area of a storage device, forms a plurality of virtual volumes from the storage
3 area logical volumes, and processes input-output request sent from a plurality of host processors
4 to one of the virtual volumes, comprising:

5 a configuration change control program for changing a configuration of
6 associating the virtual volume with the storage area that becomes a real area of the storage
7 device; and

8 a first processor that executes the configuration change control program, wherein
9 the program includes:

10 means for requesting an input-output request temporary hold to ~~another~~ a first
11 virtualization apparatus before changing the configuration of associating the virtual volume with
12 the storage area logical volumes that becomes the real area of the storage device;

means for allowing the ~~other~~first virtualization apparatus that received the request to complete all input-output requests received from that host processors that are being processed, shifting to a state of temporarily holding subsequently received input-output requests from the host processors, and returning a completion report;

means for instructing, to the ~~other~~first virtualization apparatus, an allocation change of the storage area ~~logical volumes~~ to the virtual volume when receiving the completion report from the ~~other~~first virtualization apparatus;

means for receiving the completion report of the allocation change from the ~~other~~first virtualization apparatus; and

means for sending an instruction to the ~~other~~first virtualization apparatus for releasing the input-output request that are being temporarily held,

wherein if the first virtualization apparatus does not send the completion report of the input-output processing, then the first virtualization apparatus is removed from a control range and the allocation of its storage area is not changed.

10. (Currently amended): A virtualization apparatus according to claim 9, further comprising:

a memory storing a configuration information table registering configuration information that associates the virtual volume with the storage area ~~logical volumes~~ that becomes the real area of the storage device and a difference information table that records a difference before and after a change of the configuration information;

a configuration management program for receiving a request from the configuration change control program to temporarily hold changing input-output requests and change configuration information; and

a second processor that executes the configuration management program, wherein contents of the configuration information table are updated by executing the configuration management program by the second processor.

1 11. (Original): A virtualization apparatus according to claim 10, wherein the
2 first processor and the second processor are comprised of the same processor.

1 12. (Original): A virtualization apparatus according to claim 9, wherein the
2 configuration change control program further comprises means for performing arbitration
3 processing to limit the first processor that executes the respective means of the configuration
4 change control program.

1 13. (Original): A virtualization apparatus according to claim 10, wherein the
2 configuration information table comprised of a plurality of faces is prepared and a table of each
3 face is switched.

1 14. (Currently amended): A virtualization apparatus according to claims 9,
2 further comprising:
3 when changing a configuration from a first storage area ~~the logical volumes~~ to
4 which the virtual volume corresponds to ~~another~~ a second storage area,
5 a copy processing program for copying and processing data to the ~~other~~ second
6 storage area ~~logical volumes~~; and
7 a copy progress table that manages a progress status of the copy processing of the
8 data using the copy processing program.

1 15. (Currently amended): A storage device comprising a plurality of storage
2 areas ~~logical volumes~~ for providing a real storage area and a virtualization apparatus that
3 allocates the storage areas ~~logical volumes~~, forms a plurality of virtual volumes, and processes
4 input-output requests from a plurality of host processors to one of the virtual volumes, wherein
5 the virtualization apparatus includes:
6 means for requesting an input-output temporary hold to ~~another~~ a first
7 virtualization apparatus before changing a configuration of associating the virtual volume with
8 the storage areas ~~logical volumes~~ that becomes a real area of the storage device;

9 means for allowing the ~~other~~first virtualization apparatus that received the request
10 to complete all input-output requests received from the host processors that are being processed,
11 shifting to a state of temporarily holding subsequently received input-output requests from the
12 host processors, and returning a completion report;

13 means for instructing an allocation change of the storage area~~logical volumes~~ in
14 regard to the virtual volume to the ~~other~~first virtualization apparatus when receiving the
15 completion report from the ~~other~~first virtualization apparatus;

16 means for receiving the completion report of the allocation change from the
17 ~~other~~first virtualization apparatus; and

18 means for sending an instruction to the ~~other~~first virtualization apparatus for
19 releasing the input-output request that are being temporarily held.

1 16. (Original): A storage device according to claim 15, wherein there are
2 provided a configuration change control program for realizing each of the above means and a
3 processor that executes the program.

1 17. (Currently amended): A storage device according to claim 15, wherein
2 there is provided a copy control unit for copying data from ~~logical volumes~~storage areas
3 originally allocated to a virtual volume to other ~~logical volumes~~storage areas that are
4 subsequently allocated to the virtual volume.

1 18. (Currently amended): A change method for allocation of a storage
2 ~~area~~plurality of logical volumes of a storage device to a virtual volume in a plurality of
3 virtualization apparatuses that process input-output from a plurality of host processors to the
4 virtual volume, comprising the steps of:

5 issuing, to the plurality of virtualization apparatuses, a request for temporarily
6 holding input-output requests received from the host processors after a certain point of time;

7 making the respective virtualization apparatuses change the allocation of the
8 storage area~~logical volumes~~ on the condition that a report indicating completion of the

9 processing of all input-output requests is received from the respective virtualization apparatuses;
10 and

11 releasing input-output requests that are being temporarily held after the
12 completion report of the allocation change is received from the respective virtualization
13 apparatuses,

14 wherein a virtualization apparatus that does not send the completion report of the
15 input-output processing is removed from a control range and the allocation of its storage area is
16 not changed.

1 19. (Original): A change method according to claim 18, wherein the step of
2 inputting an instruction of a configuration change from a management console is included and
3 the request for temporarily holding the input-output is issued in accordance with the input
4 instruction.

1 20. (Currently amended): A program for a configuration change that changes
2 allocation of a storage area~~plurality of logical volumes~~ of a storage device to a virtual volume in
3 a storage system including a plurality of virtualization apparatuses that allocate the storage area
4 ~~logical volumes~~, form a plurality of virtual volumes, and process input-output from a host
5 processor to one of the virtual volumes, comprising:

6 means for issuing, to the plurality of virtualization apparatuses, a request for
7 completing all input-output requests received from the host processors that are being processed
8 by the virtualization apparatuses and temporarily holding any subsequently received input-output
9 requests received from the host processors;

10 means for receiving, from the plurality of virtualization apparatuses, a report
11 indicating completion of the processing of the input-output request in response to the request for
12 completing;

13 means for instructing the allocation change of the storage area~~logical volumes~~ of
14 the storage device to all the virtualization apparatuses when receiving the completion report from
15 all the virtualization apparatuses to which the request was issued;

16 means for receiving the completion report of the allocation change from all the
17 virtualization apparatuses; and
18 means for sending an instruction to all the virtualization apparatuses for releasing
19 the input-output request that are being temporarily held,
20 wherein a virtualization apparatus that does not send the completion report of the
21 input-output processing is removed from a control range and the allocation of its storage area is
22 not changed.